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FACULTY OF SCIENCE
DEPARTMENT OF PHYSICS

12th December, 1988.

Dr. Leon Lederman,
Director,
Fermilab, P.O. Box 500,
Batavia, Illinois 60510,
U.S.A.

Dear Dr. Lederman,

We are submitting a proposal for an emulsion experiment using the Fermilab muon beam, in collaboration with Dr. Thornton Murphy. We would prefer of course the highest energy muon beam available next summer, if it is possible. We enclose a copy of the detailed proposal which consists of two stages. We would like to carry out the exposure for the first stage next summer, and the second stage at a later date. We hope this proposal will be acceptable to Fermilab, and look forward to this additional involvement with Fermilab. We look forward to a favourable reply.

Thanking you,

Yours sincerely,
Lali Chatterjee
(Lali Chatterjee)
Dipak Ghosh
(Dipak Ghosh)

CC: Dr. T. Yamanouchi
Dr. T. Murphy

Proposal for emulsion experiment to be

carried out in FERMILAB.

Deep Inelastic Muon Interaction with Nuclear Targets using Emulsion Telescope Technique.

Collaboration

Fermilab, USA; Jadavpur University, - Calcutta, India.

Participants

Fermilab :

Dr. Thornton Murphy

Jadavpur University :

Dr. Lali Chatterjee; Dr. Dipak Ghosh; Dr. Jaya Deb Roy.

We plan to carry out an emulsion experiment, the objectives of which are to study muon interaction in the deep inelastic region to obtain new information on EMC effect and deep inelastic structure functions of different specific targets.

Ever since its discovery, the EMC effect has been a challenge to experimentalists and theoreticians in the high energy physics arena. In the absence of a conclusive solution to the underlying physical phenomena and possible experimental biases investigation and clarification of the effect continues to be a front line experimental and theoretical research objective.

Existing experimental data on the subject have been reported and the deep inelastic structure functions for heavy nuclei have been compared usually with that of deuterium.

Emulsion Experiment :

First stage - In the emulsion experiment we propose to expose stacks of G5 nuclear emulsion plates to the main muon beam and this will enable us to determine the structure functions in two types of targets usually available within emulsion itself - a light (A=14) and a heavy (A=94) nuclei. We also can expose emulsion plates loaded with specific suitable targets to resolve the ambiguity of identifying the exact target (if funds permit).

Thus we can extend our study to new targets and benefits of knowledge in physics will be sizeable.

Second stage - Further, in the second stage of emulsion experiment, we propose to use an emulsion telescope technique which consists of a no. of elementary emulsion detectors around a target module in a telescope arrangement which will be exposed perpendicularly to the muon beam. The elementary detectors will be made of 200 μm plastic sheets coated on both sides with 60 μm G5 emulsion layers, whereas the target module will be made of 100μm thick sheets of different targets seperated by elementary detectors. The whole system will be exposed under a magnetic field and fiducial rays will be marked on the emulsion during radiation. The main advantages of the experimental set up are the following :

(i) 4π steradian acceptance

(ii) 1% momentum resolution

(iii) 2 mrad mean angle resolution for transverse angles

(iv) 0.04 mrad mean angle resolution for longitudinal angles of jet particles.

The scanning and measuring of the events will be performed with the help of a high resolution measurement microscope with an on line computer system. Apart from the above defined problems, there remains the possibility of new, undefined problems exhibiting themselves in the course of the experiment. In the spirit of fundamental research, the remaining *problems and objectives are left undefined at the doorstep of the unexpected.*

The schematic representation of the arrangements of elementary detectors (plastic & emulsion), and targets is shown in fig. 1. Fig. 2 shows the picture of an event, One can see the impacts of the emitted particles in different detectors placed subsequently to one another.

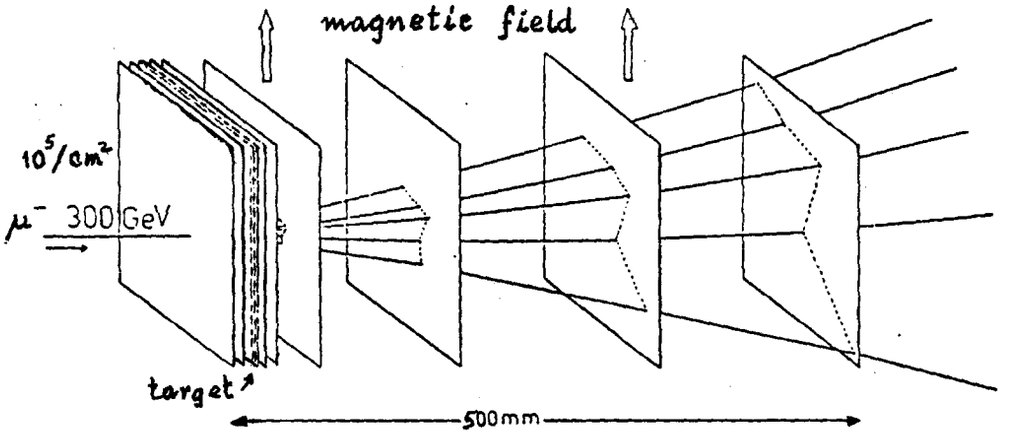

Fig. 1. Experimental Set up

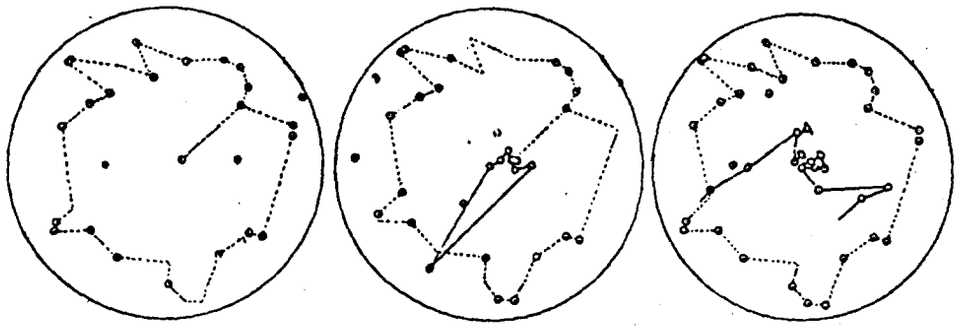

Fig. 2. Secondary impacts in transverse planes